Clean Heavy-Duty Engines and Fuels for the 21st Century

Karl Simon

U.S. Environmental Protection Agency

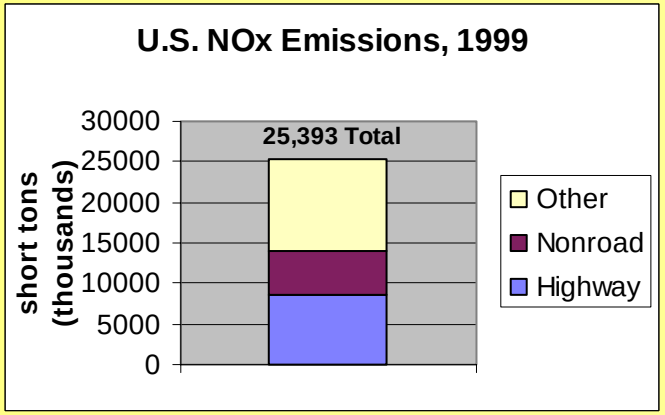
Clean Cities Conference

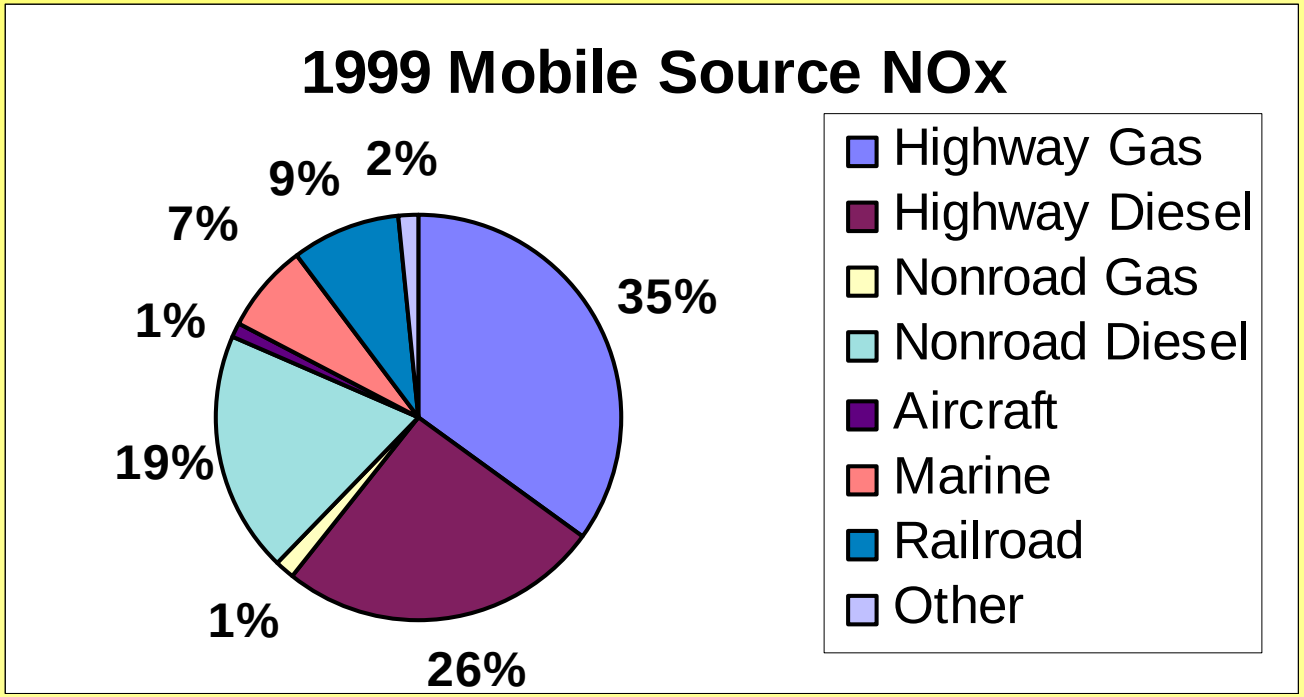
May 15, 2001

Are Vehicles Clean Enough?

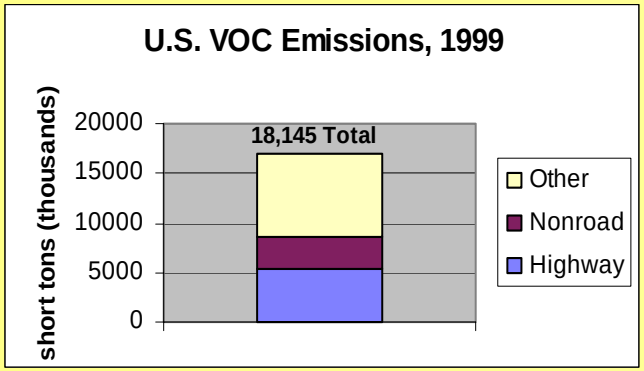
- Significant improvements in emissions performance have been achieved over the last 25 years
  - Over 90% cleaner for most emissions
- Yet, mobile source emissions remain a large part of the air pollution inventory
  - For example, heavy duty vehicles contribute up to 30% of mobile source NOx emissions
- Why? Increasing number of miles and vehicles being driven overwhelms reductions

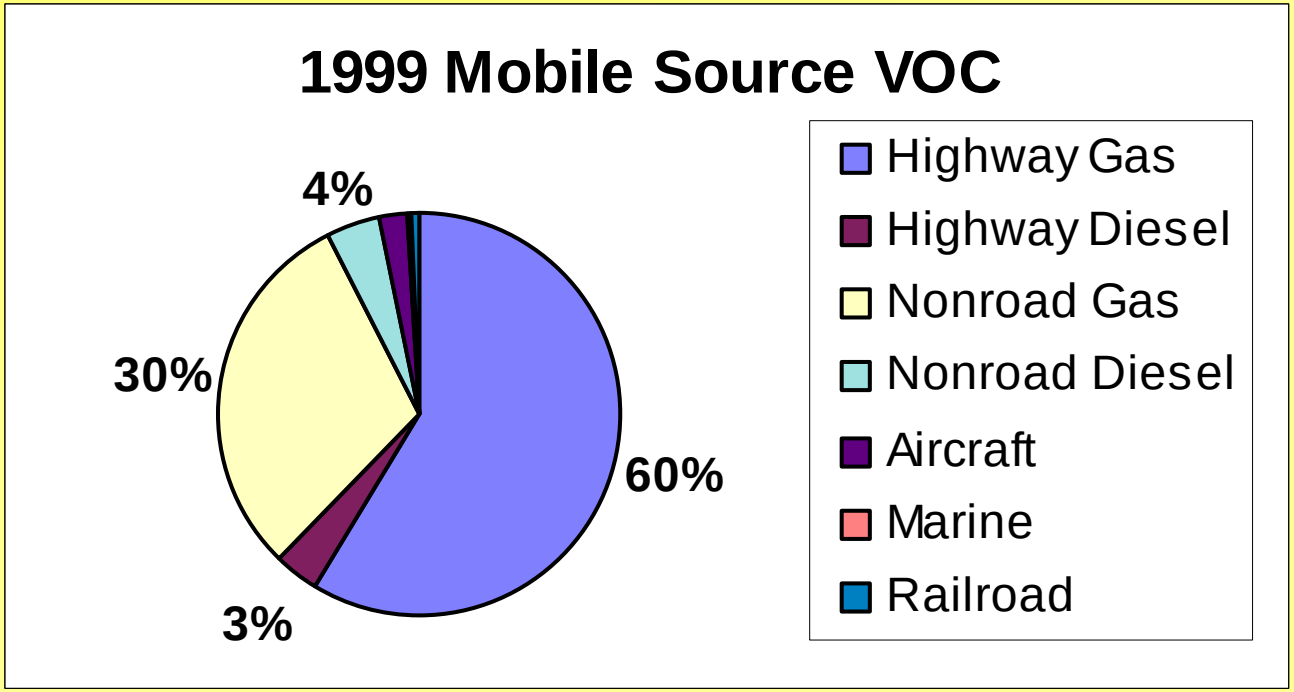
MOBILE SOURCES contributed **14.1 million** short tons of NOx in 1999, or **56%** of total U.S. NOX emissions





MOBILE SOURCES contributed **8.5 million** short tons of VOC in 1999, or **47%** of total U.S. VOC emissions





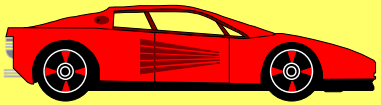
Taking A Systems View

- **Past EPA Programs:**
  Create separate programs for vehicle emission standards and cleaner fuels

- **A New Approach:**
  Regulate the vehicle and fuel as a system to optimize costs and environmental benefits
  - Light-duty Tier 2 & gasoline sulfur control
  - Heavy-duty 2007 standards & diesel sulfur control

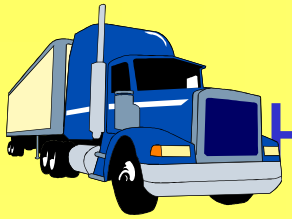
The Challenge

- Coordinating a “systems-oriented” rulemaking with diverse groups of stakeholders--
  - State and local governments
  - Vehicle owners and operators
  - Engine and vehicle manufacturers
  - Fuel refiners
  - Fuel distributors and retailers
  - Environmental and public interest groups



Tier 2 & Gasoline Sulfur

- Applies same emissions standards to passenger cars & light trucks
  - Also includes “Medium-Duty Passenger Vehicles”
  - 95% emission reductions for cars, light trucks, & SUVs
  - Phases in 2004-2009
- Reduces gasoline sulfur levels nationwide
  - Enables use of super-efficient catalytic converters
  - Gasoline sulfur reductions up to 90% (30 ppm avg / 80 ppm cap)
  - Phases in 2004-2006 for most refiners



Heavy-Duty Vehicles & Diesel Fuel

- A uniform nationwide program starting in 2006
- Limit highway diesel fuel sulfur to 15 ppm-- enables advanced exhaust emission controls
- Engine standards for 90%+ emission reductions -- gasoline-like levels
- Fuel and engine implementation flexibility
  - Credit banking and trading programs
  - Refiners can produce 20% of fuel at 500 ppm until 2010
  - Additional time for small and Western refiners to comply with fuel requirements
  - Hardship provisions

Public Health Concerns

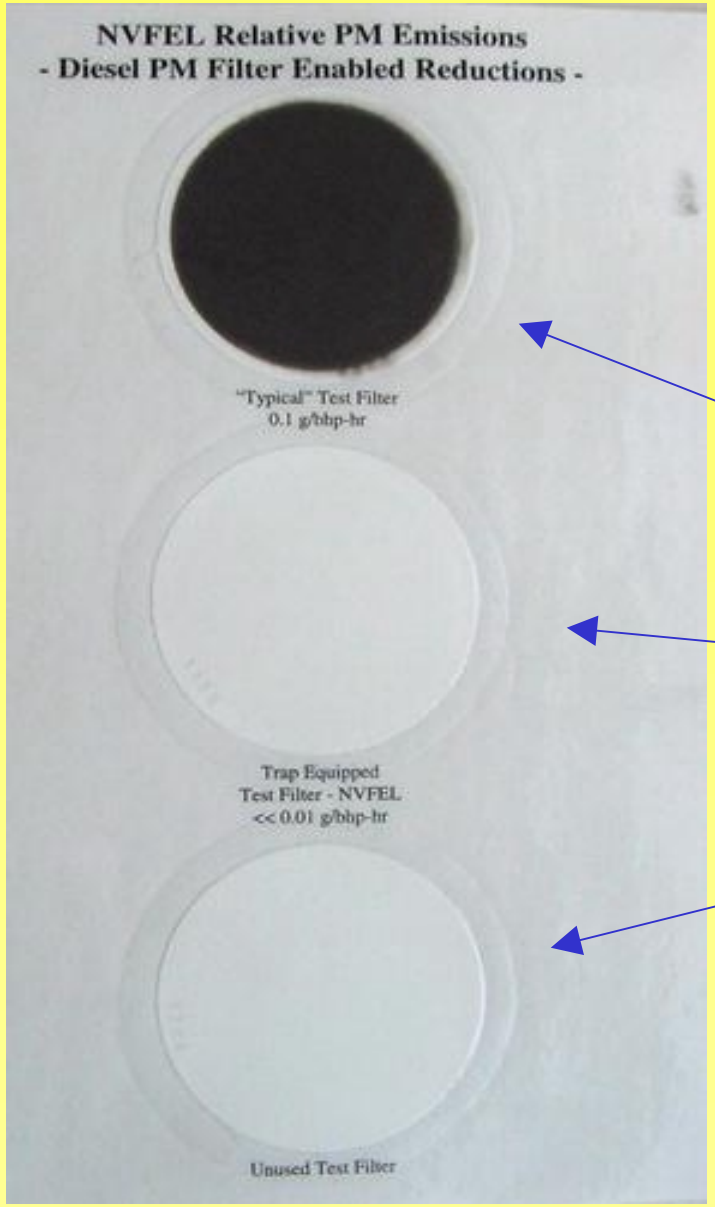
- Diesels are a major factor in dozens of large cities at risk of violating the ozone or particulate matter NAAQS
- Diesel PM has been implicated in an increased risk of lung cancer and respiratory disease
  - California has declared it a toxic air contaminant -- moving forward with control program
  - EPA has concluded (and the Clean Air Scientific Advisory Committee has approved) that diesel exhaust is likely to be carcinogenic to humans

Environmental Harm

- Visibility impairment
- Forest and crop damage
- Acid rain & acid snow melt
- Eutrophication of water bodies

Feasible 2007 Emission Control Technologies

- Catalyzed PM trap
- High-efficiency NOx adsorber
- Improved engine and catalyst designs based on proven light-duty technology



PM Emissions with Trap

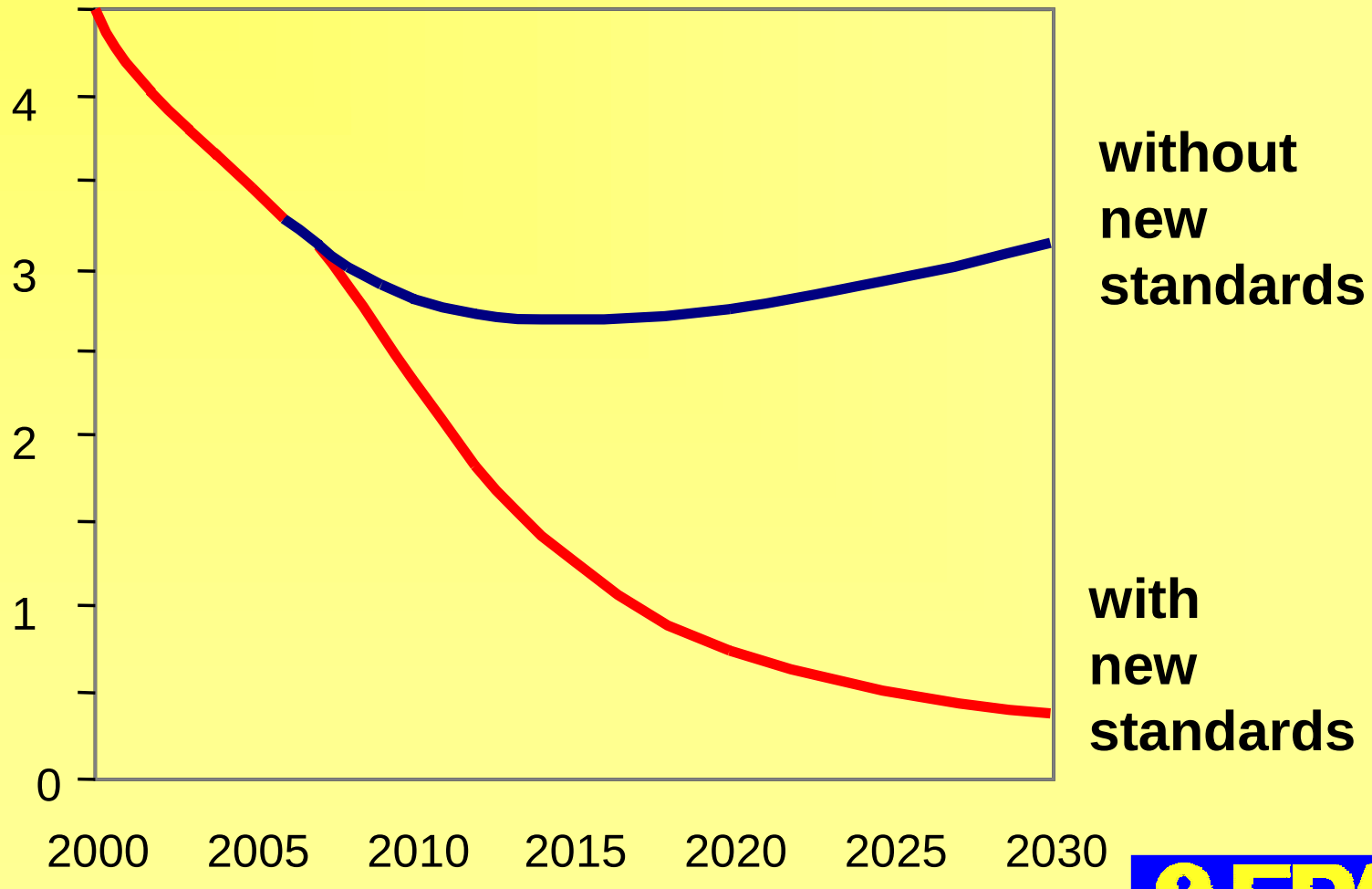
- Typical test filter – current standards
- Test filter – 2007 standards
- Unused test filter

Why 15 ppm?

- Sulfur damages promising control technologies
- Testing has demonstrated effectiveness of these technologies with sulfur-free fuel
- EPA program balances technology need with challenge of providing low-sulfur fuel
- Higher sulfur levels suggested by some would enable only low-efficiency technologies and would hurt fuel econ

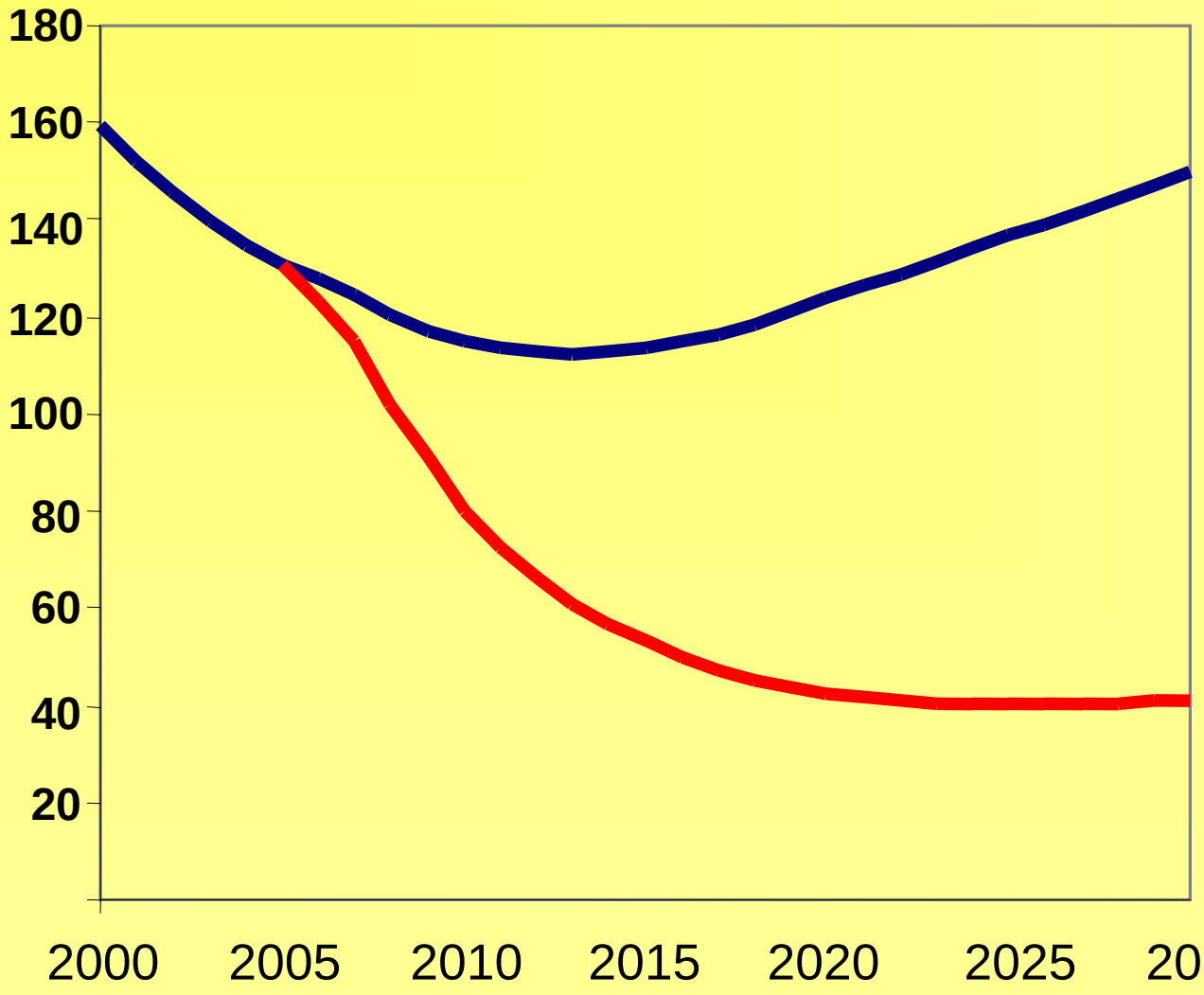
NOx Emissions

nationwide heavy-duty vehicle NOx (million tons / year)



Particulate Matter Emissions

nationwide heavy-duty vehicle PM (thousand tons / year)



without new standards

with new standards

Projected Benefits

- *The program will prevent annually:*
  - 8,300 premature deaths
  - 360,000 asthma attacks
  - 9,500 hospital admissions and ER visits
  - 1.5 million lost work days
- *On a dollar-basis*: $70 billion/year
- Large reductions in emissions of diesel toxics

What About Fuels Other Than Conventional Diesel?

- EPA standards focus on emissions performance rather than technology or fuels mandates
- As a result, the new standards will naturally encourage alternative fuels and nonconventional diesel fuels that are truly clean-burning
  - Alternative fuels could be better suited for advanced technology applications such as hybrids
- These fuels can also have a role in targeted programs such as existing fleet retrofits

Encouraging Clean Fuels & Technologies

- Highway engine rule has “Blue Sky Engine” incentive provisions:
  - rewards extra clean engines and early sales
- Also incentives for early clean fuel introduction
- Nonroad diesel program also has Blue Sky Engine incentives for voluntary marketing of extra clean designs

Program Status

- Administration announced its support for the rule
  - Implementation ongoing
- A number of parties will be involved in legal challenges to program
- Two associations filed administrative petitions for reconsideration

Voluntary Diesel Retrofit Program

- A voluntary program designed to install pollution-reducing technology on existing diesel vehicles and equipment
- Diesel Engines last a long time
  - Existing engines may last another 20-35 years
  - Diesel powered vehicles may drive a million miles
- Benefits of 2004/2007 regulations are long-term
  - Requirements are phased in between 2007 - 2010
  - Full benefits are years away
- The Voluntary Diesel Retrofit Program deals with existing engines today
  - Benefits from retrofits are immediate
  - Retrofit technology is available now

Retrofit Technology

- Retrofit technology can be:

  any change to an engine system above and beyond what is required by EPA regulations that improves the engine's emission performance:

  - Catalyst or filter
  - Engine upgrade
  - Early engine replacement
  - Use of cleaner fuels or additives
  - Combination of above

For Further Information…

- Highway diesel rule
  - www.epa.gov/otaq/diesel
- Retrofit program
  - Retrofit Web site maintains a list of manufacturers and verified technology
  - www.epa.gov/otaq/retrofit